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EXPONENTS AND LOGARITHMS

SHORT QUESTIONS

Q.1- What is meant by radical and radicands?

Ans. Let "a" be a real number and "n" be a positive integer then $(a^{1/n})$ may be written as $\sqrt[n]{a}$. Here $\sqrt[n]{a}$ is called radical of index "n" and "a" is called radicand.

Example:-

$a^{1/2} = \sqrt{a}, \sqrt{a}$ is called radical of order 2.

$a^{1/3} = \sqrt[3]{a}, \sqrt[3]{a}$ is called radical of order 3.

Q.2- Define conjugate radicals of order 2?

Ans. $\left(\sqrt{a}+\sqrt{b}\right)$ and $\left(\sqrt{a}-\sqrt{b}\right)$ are conjugate radicals to each other the product of two conjugates is always a rational number.

Q.3- Simplify $x^{1/4} \div x^{2/3}$?

Solution:-

$$x^{1/4} \div x^{2/3} = x^{1/4} \times \frac{1}{x^{2/3}}$$

$$= x^{1/4} \times x^{-2/3}$$

$$= x^{1/4-2/3} = x^{\frac{3-8}{12}}$$

$$= x^{-5/12} = \frac{1}{x^{5/12}}$$

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Q.4- Express $\sqrt[n]{27x^{18}}$ in exponential form?

Solution:-

$$\sqrt[n]{27x^{18}} = \left[27x^{18}\right]^{1/3}$$
$$= \left[3^3\,x^{18}\right]^{1/3}$$
$$= 3^{3\times 1/3}\,x^{18\times 1/3}$$
$$= 3\,x^{6} \text{ Ans.}$$

Q.5- Simplify $\sqrt{18}\times\sqrt[5]{64}$?

Solution:-

$$\sqrt{18}\times\sqrt[5]{64} = (18)^{1/2}\times(64)^{1/5}$$
$$= (9\times 2)^{1/2}\times(2\times 32)^{1/5}$$
$$= (3^2\times 2)^{1/2}\times(2\times 2^5)^{1/5}$$
$$= 3^{2\times 1/2}\times 2^{1/2}\times 2^{1/5}\times 2^{5\times 1/5}$$
$$= 3\times 2^{1/2+1/5}\times 2$$
$$= 6\times 2^{5+2/10}$$
$$= 6\times 2^{7/10} = 6\times\sqrt[10]{2^7}$$
$$= 6\times\sqrt[10]{128} \text{ Ans.}$$

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Q.6- What are the laws of exponents?

Ans. There are four laws of exponents.

(i) Law of Sum of Power:-

It states that $a^m \times a^n = a^{m+n}$ where $a \neq 0, m, n, a \in R$.

(ii) Law of Subtraction of Power:-

$$\frac{a^m}{a^n} = a^{m-n} \text{ where } a \neq 0, a, m, n, a \in R.$$

(iii) Law of Power of Product:-

It states that:

(i) $(a\,b)^n = a^n\,b^n$

(ii) $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Where $a, b \neq 0$ and $a, b, n \in R$.

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(iv) *Law of Power of Power:-*

It states that:

$(a^m)^n = a^{m\times n}$

Where $a \neq 0, a, m, n \in R$.

Q.7- What do you mean by scientific notation?

Ans. To express extra ordinary large or small numbers, we use scientific notation. In this method any number can be written as theproduct of two numbers. One of them is in between 1 and 10 and the second is positive or negative integral power of 10.i.e.

$a = b\times 10^n$ where $1<b<10$

Example:-

$10000 = 1.0\times 10^4$

$\frac{1}{1000} = 1\times 10^{-3}$

$50,000,000 = 5.0\times 10^7$

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Q.8- Define Logarithm of a positive real number.

Ans. Let $a^x = y$. Where $'a, y > 0'$ and $a \neq 0$

This exponential form of an equation may be written as $\log_a y = x$

(read as "logarithm of $'y'$ to the base $'a'$ is equal to $'x'$")

$a^x = y \Leftrightarrow \log_a y = x$

Q.9- Write a note on Common Logarithm.

Ans. Logarithm with base 10 is called Common Logarithm.

(Note : $\log_{10} a$ is written as $\log a$, no need to write 10 as base)

We have $10^1 = 10 \Leftrightarrow \log 10 = 1$

$10^2 = 100 \Leftrightarrow \log 100 = 2$

$10^{-1} = \frac{1}{10} \Leftrightarrow \log\frac{1}{10} = -1$

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Q.10- Solve the equation. $\log(x+3)=2$

Solution:-

$$\log(x+3)=2$$
$$\Rightarrow x+3=10^2$$
$$\Rightarrow x+3=100$$
$$\Rightarrow x=100-3$$
$$\Rightarrow \boxed{x=97} \text{ Ans.}$$

Q.11- Define characteristics of a number.

Ans. To find the characteristics of a number *'x'* we write it in scientific form $x=a\times 10^p$

Then *'p'* is called characteristics of *'x'*

Q.12- Add $\bar{1}.3612$, 3.1946, $\bar{2}.0018$ and $\bar{3}.4619$

Ans. $\bar{1}.3612+3.1946+\bar{2}.0018+\bar{3}.4619$

$$=-1+0.3612+3+0.1946-2+0.0018-3+0.4619$$
$$=-1+3-2-3+0.3612+0.1946+0.0018+0.4619$$
$$=-3+1.0195=-3+1+0.0195$$
$$=-2+0.0195=\bar{2}.0195 \text{ Ans.}$$

Q.13- What are Laws of Logarithm?

Ans. There are three laws of Logarithm:

(i) $\log_a(mn)=\log_a m+\log_a n$

(ii) $\log_a\left(\frac{m}{n}\right)=\log_a m-\log_a n$

(iii) $\log_a(m)^n=n\log_a m$

Q.14- Define Antilogarithm of a real number.

Ans. The inverse function of logarithm is called antilogarithm.

$$\log m=n \Rightarrow m=\text{Antilog } n$$

we have

$$\log 1000=3 \Rightarrow \text{Antilog } 3=1000$$

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SOLUTION OF EXERCISES

EXERCISE 6.1

Q.1- Determine the radicals and radicands from the following:

(i) $\sqrt{3}$ **(ii)** $4+3\sqrt{3}$ **(iii)** $\sqrt{11}$ **(iv)** $8-2\sqrt{6}$ **(v)** $\dfrac{\sqrt{5}}{7}$ **(vi)** $\dfrac{9}{\sqrt{13}}$

Ans.

(i) $\sqrt{3} \Rightarrow Radical = \sqrt{3},\ \ Radicand = 3$

(ii) $4+3\sqrt{a} \Rightarrow Radical = \sqrt{a},\ \ Radicand = a$

(iii) $\sqrt{11} \Rightarrow Radical = \sqrt{11},\ \ Radicand = 11$

(iv) $8-2\sqrt{6} \Rightarrow Radical = \sqrt{6},\ \ Radicand = 6$

(v) $\dfrac{\sqrt{5}}{7} \Rightarrow Radical = \sqrt{5},\ \ Radicand = 5$

(vi) $\dfrac{9}{\sqrt{13}} \Rightarrow Radical = \sqrt{13},\ \ Radicand = 13$

Q.2- Express the following in exponential form:

(i) $\sqrt{a^3}$ **(ii)** $\sqrt[5]{a^3}$ **(iii)** $\dfrac{1}{\sqrt[p]{a^k}}$ **(iv)** $\dfrac{1}{\sqrt[b]{a^k}}$

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Ans.

(i) $\sqrt{a^3} = (a^3)^{1/2} = (a^{3\times 1/2}) = a^{3/2}$

(ii) $\sqrt[5]{a^3} = (a^3)^{1/5} = (a^{3\times 1/5})\ a^{3/5}$

(iii) $\dfrac{1}{\sqrt[p]{a^k}} = \dfrac{1}{(a^k)^{1/p}} = \dfrac{1}{(a^{k\times 1/p})} = \dfrac{1}{(a^{k/p})} = a^{-k/p}$

(iv) $\dfrac{1}{\sqrt[b]{a^k}} = \dfrac{1}{(a^k)^{1/b}} = \dfrac{1}{(a^{k\times 1/b})} = \dfrac{1}{(a^{k/b})} = a^{-k/b}$

Q.3- Write in the radical form and evaluate the result.

(i) $(25)^{1/2}$ **(ii)** $(64)^{1/3}$ **(iii)** $(81)^{1/4}$ **(iv)** $(27)^{1/3}$

(v) $(27)^{2/3}$ **(vi)** $8^{-1/3}$ **(vii)** $(1000)^{2/3}$ **(viii)** $(64)^{1/2}$

Solution:-

(i) $(25)^{1/2} = \sqrt{25} = \sqrt{5^2} = 5$ Ans.

(ii) $(64)^{1/3} = \sqrt[3]{64} = \sqrt[3]{(4)^3} = 4$ Ans.

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(iii) $(81)^{1/4} = \sqrt[4]{81} = \sqrt[4]{(3)^4} = 3$ Ans.

(iv) $(27)^{1/3} = \sqrt[3]{27} = \sqrt[3]{3^3} = 3$ Ans.

(v) $(27)^{2/3} = \left[(27)^2\right]^{1/3} = \sqrt[3]{(27)^2} = \sqrt[3]{(3^3)^2} = \sqrt[3]{(3^2)^3} = 3^2 = 9$ Ans.

(vi) $8^{-1/3} = \sqrt[3]{8^{-1}} = \sqrt[3]{\frac{1}{8}} = \sqrt[3]{\left(\frac{1}{2}\right)^3} = \frac{1}{2}$ Ans.

(vii) $(1000)^{2/3} = \left[(1000)^2\right]^{1/3} = \sqrt[3]{(1000)^2} = \sqrt[3]{(10^3)^2}$

$= \sqrt[3]{(10^2)^3} = 10^2 = 100$ Ans.

(viii) $(64)^{1/2} = \sqrt{64} = \sqrt{8^2} = 8$ Ans.

Q.4- Simplify and answer in exponential form.

(i) $\sqrt{a^{16}}$ **(ii)** $\sqrt[3]{a^{15}}$ **(iii)** $\sqrt[3]{27a^9}$ **(iv)** $\sqrt[3]{8a^9}$ **(v)** $\sqrt[4]{x^{32}}$

(vi) $\sqrt[4]{81x^{20}}$ **(vii)** $\sqrt[3]{125x^9y^{15}}$ **(viii)** $\sqrt{(8+y)^7}$ **(ix)** $\sqrt[4]{16x^2y^6}$

(x) $\sqrt[4]{\frac{x^5y^6}{z^2}}$ **(xi)** $\sqrt[4]{\frac{8x}{x+y}}$ **(xii)** $\sqrt[p]{\frac{y^n}{a^m}}$

Solution:- (i) $\sqrt{a^{16}} = (a^{16})^{1/2} = a^{16\times 1/2} = a^8$ Ans.

(ii) $\sqrt[3]{a^{15}} = (a^{15})^{1/3} = a^{15\times 1/3} = a^5$ Ans.

(iii) $\sqrt[3]{27a^9} = (27a^9)^{1/3} = (3^3a^9)^{1/3} = 3^{3\times 1/3}a^{9\times 1/3} = 3a^3$ Ans.

(iv) $\sqrt[3]{8a^9} = (2^3a^9)^{1/3} = 2^{3\times 1/3}a^{9\times 1/3} = 2a^3$ Ans.

(v) $\sqrt[4]{x^{32}} = (x^{32})^{1/4} = x^{32\times 1/4} = x^8$ Ans.

(vi) $\sqrt[4]{81x^{20}} = (3^4x^{20})^{1/4} = 3^{4\times 1/4}x^{20\times 1/4} = 3x^5$ Ans.

(vii) $\sqrt[3]{125x^9y^{15}} = (5^3x^9y^{15})^{1/3} = 5x^{3\times 1/3}x^{9\times 1/3}y^{15\times 1/3} = 5x^3y^5$ Ans.

(viii) $\sqrt{(8+y)^7} = \left[(8+y)^7\right]^{1/2} = (8+y)^{7\times 1/2} = (8+y)^{7/2}$ Ans.

(ix) $\sqrt[4]{16x^2y^6} = (2^4x^2y^6)^{1/4} = 2^{4\times 1/4}x^{2\times 1/4}y^{6\times 1/4} = 2x^{1/2}y^{3/2}$ Ans.

(x) $\sqrt[4]{\frac{x^5y^6}{z^2}} = \left(\frac{x^5y^6}{z^2}\right)^{1/4} = \left(\frac{x^{5\times 1/4}y^{6\times 1/4}}{z^{2\times 1/4}}\right) = \frac{x^{5/4}y^{3/2}}{z^{1/2}}$ Ans.

(xi) $\sqrt[3]{\frac{8x}{x+y}} = \left(\frac{8x}{x+y}\right)^{1/3} = \left(\frac{2^3x}{x+y}\right)^{1/3} = \frac{2^{3\times 1/3}x^{1/3}}{(x+y)^{1/3}} = \frac{2x^{1/3}}{(x+y)^{1/3}}$

(xii) $\sqrt[p]{\frac{y^n}{a^m}} = \left(\frac{y^n}{a^m}\right)^{1/p} = \frac{y^{n\times 1/p}}{a^{m\times 1/p}} = \frac{y^{n/p}}{a^{m/p}}$ Ans.

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Q.5- Simplify.

(i) $\sqrt{3}\times\sqrt{7}$ *(ii)* $\sqrt[5]{4}\times\sqrt[5]{128}$ *(iii)* $\sqrt[5]{81}\times\sqrt[5]{27}$ *(iv)* $\sqrt{2}\div\sqrt[9]{32}$
(v) $\sqrt[5]{118}\div\sqrt[5]{2}$ *(vi)* $\sqrt{27}\div\sqrt{81}$ *(vii)* $a^{1/4}\times a^{2/3}$ *(viii)* $x^{6/7}\times y^{1/4}$
(ix) $(x^{3/4}\,y^{1/6})^6$ *(x)* $(x^3\,y^2)^{1/2}\times(y^3\,y^3)^{-1/3}$
(xi) $(x^2\,y^2)^{1/4}\times(x^{1/3}\,y)^{1/4}$ *(xii)* $(a^{1/4}\,b^{1/3})^{-1/2}\div(a^{1/3}\,b^{1/4})^{-5}$
(xiii) $(x^2\,y^3)^{1/5}\times(x^{1/3}\,y^2)^{1/4}$

Solution:-

(i) $\sqrt{3}\times\sqrt{7} = (3)^{1/2}\times(7)^{1/2}$

$= (3\times 7)^{1/2} = (21)^{1/2} = \sqrt{21}$ Ans.

(ii) $\sqrt[5]{4}\times\sqrt[5]{128} = (4)^{1/5}\times(128)^{1/5}$

$= (4\times 128)^{1/5} = (512)^{1/5} = \sqrt[5]{512}$ Ans.

(iii) $\sqrt[5]{81}\times\sqrt[5]{27} = (81)^{1/5}\times(27)^{1/5}$

$= (81\times 27)^{1/5}$

$= (2187)^{1/5} = \sqrt[5]{2187}$ Ans.

(iv) $\sqrt{2}\div\sqrt[9]{32} = (2)^{1/2}\div(32)^{1/9}$

$$= \frac{2^{1/2}}{(32)^{1/9}} = \frac{2^{1/2}}{(2^5)^{1/9}}$$

$$= \frac{2^{1/2}}{2^{5/9}} = 2^{(1/2-5/9)}$$

$$= 2^{9-10/18} = 2^{-1/8} = (2^{-1})^{1/18}$$

$$= \sqrt[18]{\frac{1}{2}}\ \text{Ans.}$$

(v) $\sqrt[5]{118}\div\sqrt[5]{2} = \dfrac{(118)^{1/5}}{(2)^{1/5}}$

$$= \left(\frac{118}{2}\right)^{1/5} = (59)^{1/5} = \sqrt[5]{59}\ \text{Ans.}$$

(vi) $\sqrt{27}\div\sqrt{81} = \dfrac{(27)^{1/2}}{(81)^{1/2}} = \left(\dfrac{27}{81}\right)^{1/2}$

$$= \left(\frac{1}{3}\right)^{1/2} = \sqrt{\frac{1}{3}}\ \text{Ans.}$$

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(vii) $a^{1/4} \times a^{2/3} = a^{1/4+2/3} = a^{3+8/12} = a^{11/12}$

$= \sqrt[12]{a^{11}}$ Ans.

(viii) $x^{6/7} \times y^{1/4} = x^{24/7 \times 1/4} \times y^{1/4}$

$= \left[x^{24/7} \times y\right]^{1/4} = \left[x^{24/2} \times y\right]^{1/4} = \sqrt[4]{x^{24/7} y}$ Ans.

(ix) $(x^{3/4} y^{1/6})^6 = x^{3/4 \times 6} y^{1/6 \times 6} = x^{9/2} y = y\sqrt{x^9}$ Ans.

(x) $(x^3 y^2)^{1/2} \times (y^3 x^4)^{-1/3} = x^{3 \times 1/2} y^{2 \times 1/2} \times y^{3 \times -1/3} x^{4 \times -1/3}$

$= x^{3/2} y^1 \times y^{-1} x^{-4/3} = x^{3/2-4/3} y^{1-1}$

$= x^{1/6} y^0 = x^{1/6} = \sqrt[6]{x}$ Ans.

(xi) $(x^3 y^2)^{1/4} \times (x^1 y^3)^{1/4} = x^{3/4} y^{2/4} \times x^{1/4} y^{3/4}$

$= x^{3/4+1/4} y^{2/4+3/4} = x\, y^{5/4}$

$= (x^4)^{1/4} (y^5)^{1/4} = \sqrt[4]{x^4 y^5}$ Ans.

(xii) $(a^{1/4} b^{1/3})^{-1/2} \div (a^{1/3} b^{1/4})^{-5}$

$= \dfrac{1}{(a^{1/4} b^{1/3})^{+1/2}} \div \dfrac{1}{(a^{1/3} b^{1/4})^5}$

$= \dfrac{1}{a^{1/4 \times 1/2}\, b^{1/3 \times 1/2}} \times \dfrac{a^{1/3 \times 5}\, b^{1/4 \times 5}}{1}$

$= \dfrac{a^{5/3} b^{5/4}}{a^{1/8} b^{1/6}} = a^{5/3-1/8} b^{5/4-1/6} = a^{32/24} b^{13/12}$

$= a^{32/24} b^{26/24} = \sqrt[24]{a^{32} b^{26}} = \sqrt[12]{a^{16} b^{15}}$ Ans.

(xiii) $(x^2 y^3)^{1/5} \times (x^{1/3} y^2)^{1/4}$

$= x^{2/5} y^{3/5} \times x^{1/12} y^{2/4} = x^{2/5+1/12} y^{3/5+2/4}$

$= x^{29/60} y^{11/10}$ Ans.

EXERCISE 6.2

Q.1- Write the base and exponent in the following.

(i) $16x^3$ **(ii)** x^9 **(iii)** $(4y)^3$

(iv) $(x-2)^3$ **(v)** $18x^5$ **(vi)** $5x^{3/2} \times x^{1/2}$

Solution:-

(i) $16x^3$, *Base = x and Exponent = 3.*

(ii) x^9, *Base = x and Exponent = 9.*

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(iii) $(4y)^3$, Base $= 4y$, Exponent $= 3$.

(iv) $(x-2)^3$, Base $= x-2$, Exponent $= 3$.

(v) $18x^5$, Base $= x$, Exponent $= 5$.

(vi) $5x^{3/2} \times x^{1/2} = 5x^{3/2+1/2} = 5x^2$ Base $= x$, Exponent $= 2$.

Q.2- $\sqrt{(a^2 b^3)^6} = \left[(a^2 b^3)^6\right]^{1/2}$

$$= (a^2 b^3)^{6\times1/2} = (a^2 b^3)^3 = a^{2\times3} b^{3\times3} = a^6 b^9 \text{ Ans.}$$

Q.3- $\sqrt[9]{(x^{-4} y^3)^{-3}} = \left[(x^{-4} y^3)^{-3}\right]^{1/9}$

$$= (x^{-4} y^3)^{-3\times1/9} = (x^{-4} y^3)^{-1/3}$$

$$= x^{-4\times-1/3} y^{3\times-1/3} = x^{4/3} y^{-1} = \frac{x^{4/3}}{y} \text{ Ans.}$$

Q.4- $(x^a y^{-b})^3 \times (x^3 y^2)^{-a}$

$$= x^{a\times3} y^{-b\times3} \times x^{3\times(-a)} y^{2\times(-a)}$$

$$= x^{3a} y^{-3b} \times x^{-3a} y^{-2a} = x^{3a-3b} y^{-3b-2a}$$

$$= x^0 y^{-(2a+3b)} = \frac{1}{y^{(2a+3b)}} \text{ Ans.}$$

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Q.5- $\left(\frac{16x^2}{y^{-2}}\right)^{-1/4} = \left(\frac{2^4 x^2}{y^{-2}}\right)^{-1/4}$

$$= \frac{2^{4\times-1/4} x^{2\times-1/4}}{y^{-2\times-1/4}} = \frac{2^{-1} x^{-1/2}}{y^{1/2}}$$

$$= \frac{1}{2x^{1/2} y^{1/2}} \text{ Ans.}$$

Q.6- $\left(\frac{27x^3}{8a^{-3}}\right)^{-2/3} = \left(\frac{3^3 x^3}{2^3 a^{-3}}\right)^{-2/3} = \frac{3^{3\times-2/3} x^{3\times-2/3}}{2^{3\times-2/3} a^{-3\times-2/3}}$

$$= \frac{3^{-2} x^{-2}}{2^{-2} a^2} = \frac{2^2}{3^2 a^2 x^2} = \frac{4}{9a^2 x^2} \text{ Ans.}$$

Q.7- $\left(\frac{a^{-1/2}}{4c^2}\right)^{-2} = \frac{a^{-1/2\times(-2)}}{(4)^{-2} c^{2\times(-2)}}$

$$= \frac{a}{4^{-2} c^{-4}} = 4^{+2} ac^4 = 16ac^4 \text{ Ans.}$$

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Q.8- $\sqrt{a^{-2}b} \times 3\sqrt{ab^{-3}}$

$$= (a^{-2}\,b)^{1/2} \times 3(a\,b^{-3})^{1/2}$$
$$= 3(a^{-2}\,b \times a\,b^{-3})^{1/2}$$
$$= 3(a^{-2+1}\,b^{1-3})^{1/2} = 3(a^{-1}\,b^{-2})^{1/2}$$
$$= 3\left(\frac{1}{a\,b^{2}}\right)^{1/2} = \frac{3}{a^{1/2}\,b^{2\times 1/2}} = \frac{3}{a^{1/2}\,b} \text{ Ans.}$$

Q.9- $\left(\dfrac{a^{-3}}{b^{-2/3}\,c}\right)^{-3/2} \div \dfrac{a\,b^{2}\,c}{a^{2}\,c}$

$$= \frac{a^{-3\times -3/2}}{b^{-2/3\times -3/2}\,c^{-3/2}} \times \frac{a^{2}\,c}{a\,b^{2}\,c}$$
$$= \frac{a^{9/2}}{bc^{-3/2}} \times \frac{a}{b^{2}}$$
$$= \frac{a^{9/2+1}\,c^{3/2}}{b^{1+2}} = \frac{a^{11/2}\,c^{3/2}}{b^{3}} \text{ Ans.}$$

Q.10- $\dfrac{(a^{4})^{3}\,(a^{-1}b)^{10}}{a^{2}\,b^{7}} = \dfrac{a^{4\times 3}\,a^{-1\times 10}\,b^{1\times 10}}{a^{2}\,b^{7}}$

$$= \frac{a^{12}\,a^{-10}\,b^{10}}{a^{2}b^{7}} = a^{12-10-2}\,b^{10-7}$$
$$= a^{0}\,b^{3} = 1.b^{3} = b^{3} \text{ Ans.}$$

Q.11- $\dfrac{(x^{3}y)^{3}\,(2xy)^{-2}}{4x^{-4}\,y^{-5}} = \dfrac{x^{3\times 3}\,y^{1\times 3}\,2^{-2}\,x^{-2}\,y^{-2}}{4\,x^{-4}\,y^{-5}}$

$$= \frac{x^{9-2+4}\,y^{3-2+5}}{4 \times 2^{2}}$$
$$= \frac{x^{11}\,y^{6}}{16} \text{ Ans.}$$

Q.12- $\dfrac{(a^{-5})^{3} \times (a\,b)^{15}}{a^{-1}\,b^{2}} = \dfrac{a^{-5\times 3} \times a^{15}b^{15}}{a^{-1}\,b^{2}}$

$$= a^{-15+15+1} \times b^{15-2}$$
$$= a^{1}b^{13} = a\,b^{13} \text{ Ans.}$$

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Q.13- $a^5 b^4 c^2 \div abc$

$$= \frac{a^5b^4c^2}{abc} = a^{5-1}b^{4-1}c^{2-1}$$

$$= a^4b^3c \text{ Ans.}$$

Q.14- $(2ab^2)^2 (3abc^2)^{-2} \div (ab)^{-4} (bca)^5$

$$= 2^2 a^2 b^{2\times2}(3^{-2} a^{-2} b^{-2} c^{-4}) \div \frac{a^5b^5c^5}{(ab)^4}$$

$$= \frac{4a^2b^4}{3^2 a^2 b^2 c^4} \times \frac{a^4b^4}{a^5b^5c^5}$$

$$= \frac{4a^{2-2}\, b^{4-2}}{9c^4} \times \frac{1}{a^{5-4}b^{5-4}c^5}$$

$$= \frac{4(1)b^2}{9abc^{5+4}} = \frac{4\,b^{2-1}}{9ac^9} = \frac{4\,b}{9ac^9} \text{ Ans.}$$

Q.15- $\frac{2^3 \times 6^5}{3^{-3} \times 4^{-4}} = 2^3 \times 3^3 \times 4^4 \times 6^5$

$$= 2^3 \times 3^3 \times (2^2)^4 \times (2\times 3)^5$$

$$= 2^3 \times 3^3 \times 2^{2\times4} \times 2^5 \times 3^5$$

$$= 2^{3+8+5} \times 3^{3+5} = 2^{16} \times 3^8 \text{ Ans.}$$

Q.16- $\frac{2^5 \times 9^{-1}}{27^{-3} \times 8^{-3}} = \frac{2^5 \times 27^3 \times 8^3}{9}$

$$= \frac{2^5 \times (3^3)^3 \times (2^3)^3}{(3)^2}$$

$$= \frac{2^5 \times 3^9 \times 2^9}{3^2}$$

$$= 2^{5+9} \times 3^{9-2} = 2^{14} \times 3^7 \text{ Ans.}$$

Q.17- $(2^{-3} a^4 b)^{-1} \times (4^{-2} b^{-5})$

$$= \frac{1}{2^{-3}a^4b} \times \frac{1}{4^2b^5}$$

$$= \frac{2^3}{4^2a^4b^{1+5}} = \frac{8}{16a^4b^6} = \frac{1}{2a^4b^6} \text{ Ans.}$$

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Q.18- $(3^2)^5 \div 9^3 \times 27^{-1}$

$$= \frac{3^{10}}{(3^2)^3 \times \left[(3^3)\right]^{-1}} = \frac{3^{10}}{3^6 \times 3^{-3}} = 3^{10-6+3} = 3^7$$

$$= 2187 \text{ Ans.}$$

Q.19- $\left(\frac{3}{4}\right)^{-2} \div \left(\frac{4}{9}\right)^3 \times \left(\frac{27}{16}\right)^{-1}$

$$= \frac{3^{-2}}{4^{-2}} \div \frac{4^3}{9^3} \times \frac{(27)^{-1}}{(16)^{-1}}$$

$$= \frac{3^{-2}}{4^{-2}} \div \frac{4^3}{9^3} \times \frac{(3^3)^{-1}}{(4^2)^{-1}}$$

$$= \frac{3^{-2}}{4^{-2}} \div \frac{4^3}{3^6} \times \frac{3^{-3}}{4^{-2}}$$

$$= \frac{3^{-2}}{4^{-2}} \times \frac{3^6}{4^3} \times \frac{3^{-3}}{4^{-2}}$$

$$= \frac{3^{-2}+6-3}{4^{-2+3-2}} = \frac{3^1}{4^{-1}}$$

$$= 3 \times 4 = 12 \text{ Ans.}$$

Q.20- $\left(\frac{2}{3}\right)^{-1} \div \left(\frac{4}{9}\right)^{-2} \times 27$

$$= \frac{2^{-1}}{3^{-1}} \div \left(\frac{4^{-2}}{9^{-2}}\right) \times 27 = \frac{3}{2} \times \frac{9^{-2}}{4^{-2}} \times 3^{+3}$$

$$= \frac{3 \times (3^2)^{-2} \times 3^{+3}}{2 \times (2^2)^{-2}} = \frac{3 \times 3^{(2)(-2)} \times 3^{+3}}{2 \times (2^2)^{-2}}$$

$$= \frac{3^{1-4+3}}{2^{1-4}} = \frac{3^{-0}}{2^{-3}} = 1 \times 2^3 = 8 \text{ Ans.}$$

Q.21- $\frac{5^4}{3^7} \times \frac{9^3}{15^3} \div \frac{27}{25}$

$$= \frac{5^4}{3^7} \times \frac{(3^2)^3}{(3 \times 5)^3} \times \frac{25}{27}$$

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$$= \frac{5^4}{3^7} \times \frac{3^6}{3^3 \times 5^3} \times \frac{5^2}{3^3}$$

$$= 5^{4+2-3} \times 3^{6-7-3-3} = 5^3 \times 3^{-7}$$

$$= \frac{5^3}{3^7} = \frac{125}{2187} \text{ Ans.}$$

Q.22- $a^{1/2}b^{2/3} \times a^{2/3}b^{1/4} = a^{1/2+2/3}b^{2/3+1/4}$

$$= a^{3+4/6}b^{8+3/12}$$

$$= a^{7/6}b^{11/12} \text{ Ans.}$$

Q.23- $a^{2/3}b^{5/6} \times a^{1/2}b \div (ab)^{1/3}$

$$= a^{2/3+1/2}b^{5/6+1} \div a^{1/3}b^{1/3}$$

$$= \frac{a^{7/6}b^{11/6}}{a^{1/3}b^{1/3}} = a^{7/6-1/3}b^{11/6-1/3}$$

$$= a^{7-2/6}b^{11-2/6} = a^{5/6}b^{3/2} \text{ Ans.}$$

Q.24- $(a^{1/2}\, b^{1/3}\, c^{1/4})^6$

$$= a^{1/2\times 6}b^{1/3\times 6}c^{1/4\times 6} = a^3b^2c^{3/2} \text{ Ans.}$$

Q.25- $(a^{1/2}\, b^{1/3})^{4/3} \div (a^{1/3}\, b^{1/4})^{1/2}$

$$= a^{1/2\times 4/3}b^{1/3\times 4/3} \div a^{1/3\times 1/2}b^{1/4\times 1/2}$$

$$= a^{2/3}b^{4/9} \div a^{1/6}b^{1/8} = \frac{a^{2/3}b^{4/9}}{a^{1/6}b^{1/8}}$$

$$= a^{2/3-1/6}b^{4/9-1/8} = a^{4-1/6}b^{32-9/72} = a^{3/6}b^{23/72}$$

$$= a^{1/2}b^{23/72} \text{ Ans.}$$

Q.26- $a^{2/3} \times a^{1/2} \div a^{1/4}$

$$= a^{2/3+1/2} \div a^{1/4} \pm \frac{a^{7/6}}{a^{1/4}} = a^{7/6-1/4}$$

$$= a^{14-3/12} = a^{11/12} \text{ Ans.}$$

Q.27-

(i) $4^{3/5} \times 4^{1/5} = (4)^{3/5+1/5} = 4^{4/5}$

(ii) $2^{1/8} \times 2^{3/8} = 2^{1/8+3/8} = 2^{4/8} = 2^{1/2}$

(iii) $5x^{1/3} \times 2x^{1/5} = 10x^{1/3+1/5} = 10x^{5+3/15} = 10x^{8/15}$

(iv) $x^{3/4} \times x^{2/5} = x^{3/4+2/5} = x^{15+8/20} = x^{23/20}$

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(v) $\frac{1}{2}y^{3/7} \times 4y^{2/7} = \frac{1}{2} \times 4y^{3/7+2/7} = 2y^{5/7}$

(vi) $5x^{3/2} \times x^{1/2} = 5x^{3/2+1/2} = 5x^{2}$

Q.28-

(i) $a^{2/3}b^{3/4} \times a^{1/3}b^{3/4} = a^{2/3+1/3}b^{3/4+3/4} = a^{3/3}b^{6/4} = ab^{3/2}$

(ii) $x^{3/5}y^{2/9} \times x^{1/5}y^{1/3} = x^{3/5+1/5}y^{2/9+1/3} = x^{4/5}y^{5/9}$

(iii) $2ab^{1/3} \times 3a^{3/5}b^{4/5} = 6a^{1+3/5}b^{1/3+4/5} = 6a^{8/5}b^{17/15}$

(iv) $6x^{3/7} \times \frac{1}{3}x^{1/4}y^{2/5} = 2x^{3/7+1/4}y^{2/5} = 2x^{19/28}y^{2/5}$

(v) $x^{3}y^{1/2}z^{1/3} \times x^{1/6}y^{1/3}z^{1/2} = x^{3+1/6}y^{1/2+1/3}z^{1/3+1/2}$

$= x^{18+1/6}y^{3+2/6}z^{2+3/6} = x^{19/6}y^{5/6}z^{5/6}$

Q.29-

(i) $3^{1/2} \div 3^{1/3} = \frac{3^{1/2}}{3^{1/3}} = 3^{1/2-1/3} = 3^{3-2/6} = 3^{1/6}$

(ii) $\frac{x^{4/5}}{x^{5/9}} = x^{4/5-5/9} = x^{36-25/45} = x^{11/45}$

(iii) $\frac{2x^{3/4}}{4x^{3/5}} = \frac{1}{2}x^{3/4-3/5} = \frac{1}{2}x^{15-12/20} = \frac{1}{2}x^{3/20}$

(iv) $\frac{25y^{3/5}}{20y^{1/4}} = \frac{5}{4}y^{3/5-1/4} = \frac{5}{4}y^{12-5/20} = \frac{5}{4}y^{7/20}$

(v) $x^{3}y^{2} \div x^{4/3}y^{3/5} = \frac{x^{3}y^{2}}{x^{4/3}y^{3/5}} = x^{3-4/3}y^{2-3/5} = x^{5/3}y^{7/5}$

(vi) $a^{5/9}b^{2/3} \div a^{2/5}b^{2/5} = \frac{a^{5/9}b^{2/3}}{a^{2/5}b^{2/5}} = a^{5/9-2/5}b^{2/3-2/5}$

$= a^{25-18/45}b^{10-6/15} = a^{7/45}b^{4/15}$

(vii) $10x^{4/5}y \div 5x^{2/3}y^{1/4} = \frac{10x^{4/5}y}{5x^{2/3}y^{1/4}} = 2x^{4/5-2/3}y^{1-1/4}$

$= 2x^{12-10/15}y^{4-1/4} = 2x^{2/15}y^{3/4}$

(viii) $\frac{5a^{3/4}b^{3/5}}{20a^{1/5}b^{1/4}} = \frac{1}{4}a^{3/4-1/5}b^{3/5-1/4} = \frac{1}{4}a^{11/20}b^{7/20}$

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EXERCISE 6.3

Write in scientific notation.

Q.1- 0.051

Solution:-

$$0.015 = \frac{51}{1000} = \frac{51}{10} \times \frac{1}{100} = 5.1 \times 10^{-2} \text{ Ans.}$$

Q.2- 89.99

Solution:-

$$89.99 = \frac{8999}{100} = \frac{8999}{1000} \times 10 = 8.999 \times 10^{1} \text{ Ans.}$$

Q.3- 0.424

Solution:-

$$0.424 = \frac{424}{1000} = \frac{424}{100} \times \frac{1}{10} = 4.24 \times 10^{-1} \text{ Ans.}$$

Q.4- 2566324

Solution:-

$$2566324 = \frac{2566324}{1000000} \times 1000000 = 2.566324 \times 10^{6} \text{ Ans.}$$

Q.5- 0.00000075

Solution:-

$$0.00000075 = \frac{75}{100000000} = \frac{75}{10} \times \frac{1}{10000000}$$

$$= 7.5 \times \frac{1}{10^{7}} = 7.5 \times 10^{-7} \text{ Ans.}$$

Write in decimal form.

Q.6- 0.86×10^{-4}

Solution:-

$$0.86 \times 10^{4} = \frac{86}{100} \times 10000 = 86 \times 100 = 8600 \text{ Ans.}$$

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Q.7- $\mathbf{1.345 \times 10^{-5}}$

Solution:-

$$1.345 \times 10^{-5} = \frac{1345}{1000} \times \frac{1}{10^5} = \frac{1345}{1000} \times \frac{1}{100000}$$

$$= \frac{1345}{100000000} = 0.00001345 \text{ Ans.}$$

Q.8- $\mathbf{5.1 \times 10^{-9}}$

Solution:-

$$5.1 \times 10^{-9} = \frac{51}{10} \times \frac{1}{10^9} = \frac{51}{10} \times \frac{1}{1000000000}$$

$$= \frac{51}{10000000000} = 0.0000000051$$

Q.9- $\mathbf{0.525 \times 10^{-7}}$

Solution:-

$$0.525 \times 10^{-7} = \frac{525}{1000} \times \frac{1}{10^7} = \frac{525}{1000} \times \frac{1}{10000000}$$

$$= \frac{525}{10000000000} = 0.0000000525 \text{ Ans.}$$

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Q.10- $\mathbf{636.5 \times 10^{-6}}$

Solution:-

$$636.5 \times 10^{-6} = \frac{6365}{10} \times \frac{1}{10^6} = \frac{6365}{10} \times \frac{1}{1000000}$$

$$= \frac{6365}{10000000} = 0.0006365 \text{ Ans.}$$

Simplify and write in scientific notation.

Q.11- $\mathbf{\dfrac{0.96 \times 10^7}{2 \times 10^4}}$

Solution:-

$$\frac{0.96 \times 10^7}{2 \times 10^4} = 0.48 \times 10^{7-4} = \frac{48}{100} \times 10^3$$

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$$= \frac{48}{10} \times \frac{1}{10} \times 1000 = 4.8 \times 100 = 4.8 \times 10^2 \text{ Ans.}$$

Q.12- $\mathbf{\frac{2.61 \times 4 \times 10^8}{10^3}}$

Solution:-

$$\frac{2.61 \times 4 \times 10^8}{10^3} = 10.44 \times 10^{8-3} = 10.44 \times 10^5$$

$$= 1.044 \times 10^{5+1} = 1.044 \times 10^6 \text{ Ans.}$$

Q.13- $\mathbf{\frac{521 \times 10^3 \times 12}{2 \times 10^2}}$

Solution:-

$$\frac{521 \times 10^3 \times 12}{2 \times 10^2} = 521 \times 6 \times 10^{3-2} = 3126 \times 10$$

$$= 31260 = 3.1260 \times 10^4 \text{ Ans.}$$

Q.14- Convert 4.5×10^5cm into meters and write the solution in decimal form.

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Solution:-

We know the $100cm = 1m$.

$$So = 4.5 \times 10^5 cm = \frac{4.5 \times 10^5}{100} m.$$

$$= \frac{450000}{100} m. = 4500m \text{ Ans.}$$

Q.15- The radius of earth is 6400km. Convert it into meters and write the solution in scientific nation.

Solution:-

Radius of earth $= 6400\ km$

$= 6400 \times 1000m \quad \because 1km = 1000\ m$

$= 6400000\ m$

$= 6.4 \times 10^6\ m$ Ans.

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EXERCISE 6.4

Q.1- Write down the characteristic of the logarithms of the following numbers.

(i) **6350** **(ii)** **2035.6** **(iii)** **2.057**
(iv) **0.8657** **(v)** **0.0732** **(vi)** **0.000721**

Solution:-

(i) Characteristic of $6350 = 3$.
(ii) Characteristic of $2035.6 = 3$.
(iii) Characteristic of $2.057 = 0$.
(iv) Characteristic of $0.8657 = -1$.
(v) Characteristic of $0.0732 = -2$.
(vi) Characteristic of $0.000721 = -4$.

Q.2- Write down the values of:

(i) **log 52.13** **(ii)** **log 6.304** **(iii)** **log 0.6127**
(iv) **log 0.0057** **(v)** **log 0.00003**

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Solution:-

(i) $\log 52.13 = ?$
Characteristic $= 1$
Mantissa $= .7170$ Ans.
Thus $\log 52.13 = 1.7170$

(ii) $\log 6.304 = ?$
Characteristic $= 0$
Mantissa $= .7996$
Thus $\log 6.304 = 0.7996$ Ans.

(iii) $\log 0.6127 = ?$
Characteristic $= -1$
Mantissa $= .7873$
Thus $\log 0.6127 = \bar{1}.7873$ Ans.

(iv) $\log 0.0057 = ?$
Characteristic $= -3$

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Mantissa = $.7559$

Thus $\log 0.0057 = \bar{3}.7559$ Ans.

(v) $\log 0.00003 = ?$

Characteristic = -5

Mantissa = $.4771$

Thus $\log 0.00003 = \bar{5}.4771$ Ans.

Q.3- If log 6374 = 3.8044, write down the values of:

(i) **log 6.374** ***(ii)*** **log 0.6374** ***(iii)*** **log 0.00637**

Solution:-

(i) $\log 6.374 = ?$

As we are given that $\log 6374 = 3.8044$

It shows that for $\log 6.374$

Characteristic = 0

Mantissa = $.8044$

Thus $\log 6.374 = 0.8044$. Ans.

(ii) $\log 0.374 = ?$

We learn from Part *(i)*

Characteristic = -1

Mantissa = $.8044$

$\log 0.6374 = \bar{1}.8044$. Ans.

(iii) Similarly

$\log 0.006374 = \bar{3}.8044$. Ans.

Q.4- ***(i)*** **If log x = 2.0374, find x.**

(ii) **If log x = 0.1597, find x.**

(iii) **If log x = 4.4236, find x.**

Solution:-

(i) $\log x = \bar{2}.0374, x = ?$

$\Rightarrow x =$ Antilog $\bar{2}.0374$

Thus characteristic of $x = -2$

Mantissa of $x = .0374$

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Now from antilogarithm table, the number against $.0374$ is 1090. So

$x = \text{Antilog } \bar{2}.0374 = 0.01090$ Ans.

(ii) $\log x = 0.1579, x = ?$

$\Rightarrow x = \text{Antilog } 0.1597$

Characteristic of $x = 0$

Mantissa of $x = .1597$

From table of antilogarithm, against $.1597$ is 1444. Thus

$x = \text{Antilog } 0.1597 = 1.444$ Ans.

(iii) $\log x = 4.4236, x = ?$

$\Rightarrow x = \text{Antilog } 4.4236$

Characteristic of $x = 4$

Mantissa of $x = .4236$

From table of antilogarithm. The number again $.4236$ is 2653. Thus

$x = \text{Antilog } 4.4236 = 26530.0$ Ans.

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EXERCISE 6.5

Q.1- Solve

Solution:-

(i) $\dfrac{\log 81}{\log 9} = \dfrac{\log 9^2}{\log 9}$

$= \dfrac{2 \log 9}{\log 9} = 2$ Ans.

(ii) $\dfrac{\log 36}{\log 6} = \dfrac{\log 6^2}{\log 6}$

$= \dfrac{2 \log 6}{\log 6} = 2$ Ans.

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(iii) $\dfrac{\log 243}{\log 9} = \dfrac{\log 3^5}{\log 3^2}$

$= \dfrac{5 \log 3}{2 \log 3} = \dfrac{5}{2}$ Ans.

Q.2- Evaluate

Solution:-

(i) $\log 5 + \log 4 + \log 3 - \log 6$

$= \log 5 + \log 2^2 + \log 3 - \log (2 \times 3)$

$= \log 5 + 2 \log 2 + \cancel{\log 3} - \log 2 - \cancel{\log 3}$

$= \log 5 + \log 2 = \log (5 \times 2) = 1$ Ans.

(ii) $\log 5 + \log 20 + \log 24 + \log 25 - \log 60$

$= \log (5 \times 20 \times 24 \times 25) - \log 60$

$= \log \dfrac{5 \times \cancel{20} \times \cancel{24}^{8} \times 25}{\cancel{60}} = \log 1000$

$= \log 10^3 = 3 \log 10$

$= 3 (1) = 3$ Ans.

(iii) $2 \log 3 + 3 \log 4 + 4 \log 5 - 2 \log 6$

$= \log 3^2 + \log 4^3 + \log 5^4 - \log 6^2$

$= \log \dfrac{3^2 \times 4^3 \times 5^4}{6^2}$

$= \log \dfrac{3 \times \cancel{2} \times \cancel{4} \times 4 \times 4 \times 5 \times 5 \times 5 \times 5}{\cancel{6} \times \cancel{6}}$

$= \log (10000) = \log 10^4$

$= 4 \log 10 = 4 (1)$

$= 4$ Ans.

(iv) $2 \log 5 + \log 8 - \dfrac{1}{2} \log 4$

$= \log 5^2 + \log 8 - \log (4)^{1/2}$

$= \log \dfrac{5^2 \times 8}{(4)^{1/2}} = \log \dfrac{25 \times 8}{2}$

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$= \log 100 = \log 10^2$

$= 2 \log 10 = 2\,(1) = 2$ Ans.

(v) $\log 200 + \log 5$

$= \log (200 \times 5) = \log 1000$

$= \log 10^3$

$= 3 \log 10 = 3\,(1) = 3$ Ans.

Q.3- Simplify without using logarithm table.

(i) log 1.3472 + log 22.79 – log 5

(ii) log 22.13 + log 0.354 + log 7 – log 3

(iii) log 57.86 + log 4.385 – log 2.391 – log 3.072

Ans. Solution:-

(i) $\log 1.3472 + \log 22.79 - \log 5$

$= \log\left(\frac{1.3472 \times 22.79}{5}\right)$ Ans.

(ii) $\log 22.13 + \log 0.354 + \log 7 - \log 3$

$= \log\left(\frac{22.13 \times 0.354 \times 7}{3}\right)$ Ans.

(iii) $\log 57.86 + \log 4.385 - \log 2.391 - \log 3.072$

$= \log\left(\frac{57.86 \times 4.385}{2.391 \times 3.072}\right)$ Ans.

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Q.4- Solve with the help of logarithm table.

(i) $\frac{2.38 \times 3.901}{4.83}$ **(ii)** $\frac{8.67 \times 3.94}{1.78}$

(iii) $\frac{25.36 \times 3.4569}{9.87 \times 8.93}$

Solution:- Let us suppose that

(i) $x = \frac{2.38 \times 3.901}{4.83}$

Taking log of both sides.

$\log x = \log \frac{2.38 \times 3.901}{4.83}$

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Now using laws of logarithm.

$$\log x = \log 2.38 + \log 3.901 - \log 4.83$$

By using table solve the logarithms.

$$\log x = 0.3766 + 0.5912 - 0.6839$$
$$= 0.9678 - 0.6839$$
$$\log x = 0.2839$$
$$x = Antilog\ 0.2839$$
$$x = 1.923$$

Thus $\dfrac{2.38 \times 3.901}{4.83} = 1.923$ Ans.

(ii) Let us suppose that

$$x = \frac{8.67 \times 3.94}{1.78}$$

Taking log of both sides.

$$\log x = \log \frac{8.67 \times 3.94}{1.78}$$

Using laws of logarithm. We get

$$\log x = \log 8.67 + \log 3.94 - \log 1.78$$

To find the log, using table of logarithm.

$$\log x = 0.9380 + 0.5955 - 0.2504$$
$$= 1.5335 - 0.2504$$
$$\log x = 1.2831$$
$$x = Antilog\ 1.2831$$
$$x = 19.19$$

Thus $\dfrac{8.67 \times 3.94}{1.78} = 19.19$ Ans.

(iii) Let us suppose that

$$x = \frac{25.36 \times 3.4569}{9.87 \times 8.93}$$

Taking log of both sides.

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$$\log x = \log \frac{25.36 \times 3.4569}{9.87 \times 8.93}$$

Using laws of logarithm.

$\log x = \log 25.36 + \log 3.4569 - \log 9.87 - \log 8.93$

Using logarithm table solve loges.

$\log x = 1.4041 + 0.5387 - 0.9949 - 0.9509$

$\log x = 1.9428 - 1.9452$

$\log x = -0.0024 \quad = -1 + 1 - 0.0024 \quad = -1 + 0.9976$

$\log x = \bar{1}.9976$

$x = \text{Antilog } \bar{1}.9976 \quad = 0.9945$ Ans.

Q.5- Prove That

(i) $\log\left(\frac{a^2}{bc}\right) + \log\left(\frac{b^2}{ca}\right) + \log\left(\frac{c^2}{ab}\right) = 0$

(ii) $3 \log 2 + 2 \log 3 + \log 5 = \log 360$

(iii) $5 \log 3 - \log 9 = \log 27$

(iv) $\log\left(\frac{75}{16}\right) + \log\left(\frac{32}{243}\right) - 2 \log\left(\frac{5}{9}\right) = \log 2$

(v) $2 \log\left(\frac{11}{3}\right) + \log\left(\frac{130}{77}\right) - \log\left(\frac{55}{91}\right) = \log 2$

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(i) $\log\left(\frac{a^2}{bc}\right) + \log\left(\frac{b^2}{ca}\right) + \log\left(\frac{c^2}{ab}\right) = 0$

L.H.S $= \log\left(\frac{a^2}{bc}\right) + \log\left(\frac{b^2}{ca}\right) + \log\left(\frac{c^2}{ab}\right)$

$= \log 1\left(\frac{a^2 \times b^2 \times c^2}{bc.ca.ab}\right) = \log\left(\frac{a^2b^2c^2}{a^2b^2c^2}\right)$

$= \log 1 = 0 =$ R.H.S.

(ii) $3 \log 2 + 2 \log 3 + \log 5 = \log 360$

L.H.S. $= 3 \log 2 + 2 \log 3 + \log 5$

$= \log 2^3 + \log 3^2 + \log 5 \quad = \log (2^3 \times 3^2 \times 5)$

$= \log (8 \times 9 \times 5) = \log 360 = R.H.S$

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(iii) $5 \log 3 - \log 9 = \log 27$

$$\text{L.H.S.} = 5 \log 3 - \log 9 = \log 3^5 - \log 3^2$$

$$= \log\left(\frac{3^5}{3^2}\right) + \log 3^{(5-2)}$$

$$= \log 3^3 = \log 27 = \text{R.H.S.}$$

(iv) $\log\left(\frac{75}{16}\right) + \log\left(\frac{32}{243}\right) - 2\log\left(\frac{5}{9}\right) = \log 2$

$$\text{L.H.S.} = \log\frac{75}{16} + \log\frac{32}{243} - 2\log\frac{5}{9}$$

$$= \log 75 - \log 16 + \log 32 - \log 243 - 2[\log 5 - \log 9]$$

$$= \log(5^2 \times 3) - \log 16 + \log(16 \times 2)$$

$$- \log 3^5 - 2\log 5 + 2\log 3^2$$

$$= 2\log 5 + \log 3 - \log 16 + \log 16$$

$$+ \log 2 - 5\log 3 - 2\log 5 + 4\log 3$$

$$= \log 2 = \text{R.H.S.}$$

(v) $2\log\left(\frac{11}{13}\right) + \log\left(\frac{130}{77}\right) - \log\left(\frac{55}{91}\right) = \log 2$

$$\text{L.H.S.} = 2[\log 11 - \log 13) + \log 130 - \log 77$$

$$- \log(5 \times 11) + \log(13 \times 7)]$$

$$= 2\log 11 - 2\log 13 + \log 2 + \log 5 + \log 13 - \log 7$$

$$- \log 11 - \log 5 - \log 11 + \log 13 + \log 7$$

$$= \log 2 = \text{R.H.S.}$$

Q.6- Show that: $3\log 4 + 2\log 5 - \frac{1}{3}\log 64 - \frac{1}{2}\log 16 = 2$

Solution:-

$$\text{L.H.S.} = 3\log 4 + 2\log 5 - \frac{1}{3}\log 64 - \frac{1}{2}\log 16$$

$$= 3\log 4 + 2\log 5 - \frac{1}{3}\log(4)^3 - \frac{1}{2}\log 4^2$$

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$$= 3\log 4 + 2\log 5 - \frac{1}{3}.3\log 4 - \frac{1}{2}.2\log 4$$

$$= 3\log 4 + 2\log 5 - \log 4 - \log 4$$

$$= 3\log 4 - 2\log 4 + \log 5^2$$

$$= \log 4 + \log 25 = \log(4 \times 25)$$

$$= \log 100 = \log 10^2 = 2\log 10 = 2(1) = 2$$

Q.7- Show that: log (1×2×3) = log 1 + log 2 + log 3

Solution:-

$$\log(1 \times 2 \times 3) = \log 1 + \log 2 + \log 3$$

$$\log(6) = \log 1 + \log 2 + \log 3$$

Taking logs

$$0.7782 = 0.0000 + 0.301 + 0.4771$$

$$\Rightarrow 0.7782 = 0.7782$$

L.H.S. = R.H.S.

Q.8- Using logarithmic table evaluate the following:

(i) $69.13 \times 0.34 \times 0.014$ *(ii)* $\dfrac{8.67 \times 3.94}{1.78}$

(iii) $\dfrac{4}{3} \times 3.0142 \times (1.5)^2$ *(iv)* $\dfrac{(23.56)^2 \times (0.4569)}{847.5}$

(v) $\dfrac{0.9876 \times (16.42)^2}{(4.567)^{1/3}}$ *(vi)* $\sqrt{\dfrac{3\sqrt{0.0125} \times \sqrt{31.15}}{0.00081}}$

(vii) $\dfrac{(6.45)^3 \times (0.00034)^{1/3} \times (981.9)}{(9.37)^2 \times (8.93)^{1/4} \times (0.0617)}$

(viii) $\dfrac{(0.0437)^{2/3} \times (1.407)^2}{(0.0015)^{1/3} \times (1.235)^{1/7}}$

Solution:-

(i) Let us suppose that:

$$x = 69.13 \times 0.34 \times 0.014$$

Taking log of both sides.

$$\log x = \log 69.13 + \log 0.34 + \log 0.014$$

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$$= 1.8397 + 1.5315 + 2.1461$$

$$= 1.8397 - 1 + 0.5315 - 2 + 0.1461$$

$$= 1.8397 + 0.5315 - 0.1461 - 1 - 2$$

$$= 2.5173 - 3 = - 0.4827$$

$$\log x = - 1 + 1 - 0.4827 = - 1 + 0.5173$$

$$\log x = 1.5173$$

$$x = \text{Antilog } 1.5173$$

$$x = 0.3291 \text{ Ans.}$$

(ii) Let:

$$x = \frac{8.67 \times 3.94}{1.78}$$

$$\log x = \log \frac{8.67 \times 3.94}{1.78}$$

$$= \log 8.67 + \log 3.94 - \log 1.78$$

$$= 0.9380 + 0.5955 - 0.2504$$

$$= 1.5335 - 0.2504$$

$$\log = 1.2831$$

$$x = \text{Antilog } 1.2831 = 19.19$$

Thus given expression = 19.19 Ans.

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(iii) Let:

$$x = \frac{4}{3} \times 3.142 \times (1.5)^3$$

$$\log x = \log \left[\frac{4}{3} \times 3.142 \times (1.5)^3 \right]$$

$$= \log 4 + \log 3.142 + 3 \log 1.5 - \log 3$$

$$= 0.6021 + 0.4972 + 3\,(0.1761) - 0.4771$$

$$= 1.0993 + 0.5283 - 0.4771$$

$$= 1.6276 - 0.4771$$

$$\log x = 1.1505$$

$$x = \text{Antilog } 1.1505 = 17.75$$

Thus given expression = 17.75 Ans.

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(iv) Let:

$$x = \frac{(25.36)^2 \times (0.4569)}{847.5}$$

$$\log x = \log \frac{(25.36)^2 \times (0.4569)}{847.5}$$

$$= 2 \log 25.36 + \log 0.4569 - \log 847.5$$

$$= 2\,(1.4041) + (\bar{1}.6599) - 2.9282$$

$$\log x = 2.8082 - 1 + 0.6599 - 2.9282$$

$$= 3.4681 - 3.9282 \;\; = -\,0.4601$$

$$\log x = -1 + 1 - 0.4601$$

$$= -1 + 0.5399 = \bar{1}.5399$$

$$\log x = \bar{1}.5399$$

$$x = \text{Antilog } \bar{1}.5399$$

$$x = 0.3466$$

Thus given expression = 0.3466 Ans.

(v) Let:

$$x = \frac{0.9876 \times (16.42)^2}{(4.567)^{1/3}}$$

Taking log of both sides.

$$\log x = \log \frac{0.9876 \times (16.42)^2}{(4.567)^{1/3}}$$

$$= \log 0.9876 + 2 \log 16.42 - \frac{1}{3} \log 4.576$$

$$\log x = \bar{1}.9946 + 2[1.2153] - \frac{1}{3}(0.6597)$$

$$= -1 + 0.9946 + 2.4306 - 0.2199$$

$$= 3.4252 - 1.2199$$

$$\log x = 2.2053$$

$$x = \text{Antilog } 2.2053 = 160.4$$

Thus given expression = 160.4 Ans.

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(vi) Let:

$$x = \sqrt{\frac{3\sqrt{0.0125} \times \sqrt{31.15}}{0.00081}}$$

$$\log x = \log \left[\frac{3(0.0125)^{1/2} \times (0.0125)^{1/2}}{0.00081}\right]^{1/2}$$

$$\log x = \frac{1}{2}[\log 3 + \log (0.0125)^{1/2} + \log (31.15)^{1/2} - \log (0.00081)]$$

$$= \frac{1}{2}[\log 3 + \frac{1}{2}\log 0.0125 + \frac{1}{2}\log 31.15 - \log 0.00081]$$

$$= \frac{1}{2}[0.4771 + \frac{1}{2}(\bar{2}.0969) + \frac{1}{2}(1.4935) - (\bar{4}.9085)]$$

$$= \frac{1}{2}[0.4771 + \frac{1}{2}(-2 + 0.0969) + \frac{1}{2}(1.4935) - (-4 + 0.9085)]$$

$$= \frac{1}{2}[0.4771 - 1 + 0.0485 + 0.7467 + 4 - 0.9085]$$

$$= \frac{1}{2}[+3 + 1.2713 - 0.9085]$$

$$= \frac{1}{2}[3.3628] = 1.6814$$

$\log x = 1.6814$

$x =$ Antilog 1.6814

$x = 48.01$

Thus given expression = 48.01 Ans.

(vii) Let:

$$x = \frac{(6.45)^3 \times (0.00034)^{1/3} \times (981.9)}{(9.37)^2 \times (8.93)^{1/4} \times (0.0617)}$$

$$\log x = \log \frac{(6.45)^3 \times (0.00034)^{1/3} \times (981.9)}{(9.37)^2 \times (8.93)^{1/4} \times (0.0617)}$$

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$$= 3\log 6.45 + \frac{1}{3}\log 0.00034 + \log 981.9$$

$$- 2\log 9.37 - \frac{1}{4}\log 8.93 - \log 0.0617$$

$$= 3(0.8096) + \frac{1}{3}(\bar{4}.5315) + 2.9921 - 2(0.9717)$$

$$-\frac{1}{4}(0.9509) - \bar{2}.7903$$

$$= 2.4288 + \frac{1}{3}(-4 + 0.5315) + 2.9921 - (1.9434)$$

$$-0.2377 - [2 + 0.7903]$$

$$= 2.4288 + \frac{1}{3}(-3.4685) + 2.9921 - 1.9434 - 0.2377$$

$$+ 2 - 0.7903$$

$$= 2.4288 - 1.1568 + 2.9921 - 1.9434 - 0.2377$$

$$+ 2 - 0.7903$$

$$= 7.4209 - 4.1276 = 3.2933$$

$$\log x = 3.2933$$

$$x = \text{Antilog } 3.2933 = 1964.00$$

Thus given expression = 1964.00 Ans.

(viii) Let:

$$x = \frac{(0.0437)^{2/3} \times (1.407)^2}{(0.0015)^{1/3} \times (1.235)^{1/7}}$$

$$\log x = \log \frac{(0.0437)^{2/3} \times (1.407)^2}{(0.0015)^{1/3} \times (1.235)^{1/7}}$$

$$= \log(0.0437)^{2/3} + \log(1.407)^2 - \log(0.0015)^{1/3} - \log(1.235)^{1/7}$$

$$= \frac{2}{3}\log(0.0437) + 2\log 1.407 - \frac{1}{3}\log(0.0015) - \frac{1}{7}\log(1.235)$$

$$= \frac{2}{3}(\bar{2}.6405) + 2(0.1483) - \frac{1}{3}(\bar{3}.1761) - \frac{1}{7}(0.0917)$$

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$$= \frac{2}{3}(-2 + 0.6405) + 0.2966 - \frac{1}{3}(-3 + 0.1761) - 0.0131$$

$$= \frac{2}{3}(-1.3595) + 0.2966 + 1 - 0.0587 - 0.0131$$

$$= 2(-0.4532) + 1.2966 - 0.0718$$

$$= -0.9064 + 1.2966 - 0.0718$$

$$= 1.2966 - 0.9782 = 0.3184$$

$$\log x = 0.3184$$

$$x = \text{Antilog } 0.3184 = 2.082$$

Thus given expression = 2.082 Ans.

Q.9- If $v = \sqrt{\dfrac{g\ell}{2\pi}}$ find v. When $\ell = 150$, $g = 32.16$, $\pi = 3.142$.

Solution:-

As $\ell = 150, g = 32.16, \pi = 3.142.$

and $v = \sqrt{\dfrac{g\ell}{2\pi}}$

So $v = \sqrt{\dfrac{32.16 \times 150}{2 \times 3.142}}$

$$\log v = \log\left(\frac{32.16 \times 150}{6.284}\right)^{1/2}$$

$$= \frac{1}{2}[\log 32.16 + \log 150 - \log 6.284]$$

$$= \frac{1}{2}(1.5073 + 2.1761 - 0.7983)$$

$$= \frac{1}{2}(3.6834 - 0.7983)$$

$$\log v = \frac{1}{2}(2.8851) = 1.4426$$

$$v = \text{Antilog } 1.4426 = 27.71 \text{ Ans.}$$

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Q.10- If $H = \dfrac{I^2 Rt}{4.2}$, when I = 1.3, R = 6.7, and t = 25

Solution:-

As $I = 1.3,\ R = 6.7$ and $t = 2.5$

So. $H = \dfrac{I^2 Rt}{4.2}$

$$H = \frac{(1.3)^2 \times 6.7 \times 25}{4.2}$$

$$\log H = \log\left(\frac{(1.3)^2 \times 6.7 \times 25}{4.2}\right)$$

$$= \log (1.3)^2 + \log 6.7 + \log 25 - \log 4.2$$

$$= 2 \log 1.3 + \log 6.7 + \log 25 - \log 4.2$$

$$= 2[0.1139] + 0.8216 + 1.3979 - 0.6232$$

$$= 0.2278 + 0.8216 + 1.3979 - 0.6232$$

$$= 2.4473 - 0.6232 = 1.8241$$

$$\log H = 1.8241$$

$H =$ Antilog $1.8241 = 66.70$ Ans.

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Q.11- Find h, if $h = \dfrac{v}{\pi(R^2 - r^2)}$, when $v = 1190$, $R = 83.6$, r = 62.4, and $\pi = 3.14$.

Solution:- We are given that

$v = 1190,\ R = 83.6\ r = 262.4$ and $\pi = 3.14$

So $h = \dfrac{v}{\pi (R^2 - r^2)}$

$$h = \frac{1190}{3.14\left((83.4)^2 - (62.4)^2\right)}$$

$$\log h = \log \frac{1190}{3.14(6955.56 - 3893.76)}$$

$$= \log \frac{1190}{3.14 \times 3061.80}$$

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$= \log 1190 - \log 3.14 - \log 3061.80$

$= 3.0755 - 0.4969 - 3.4858$

$= 3.0755 - 3.9827 = -0.9082$

$= -1 + 1 - 0.9082 = -1 + 0.0918 = \bar{1}.0918$

$h = \text{Antilog } \bar{1}.0918 = 0.1235$ Ans.

Review Exercise-6

Q.1- Encircle the correct answer.

(i) $\sqrt{3}$ is:
(a) a rational number (b) an irrational number
(c) a natural number (d) an integer

(ii) $\sqrt[3]{7}$ is called:
(a) radical (b) radicand
(c) rational number (d) integer

(iii) In $\sqrt{3}$, 3 is called.
(a) radical (b) radicand
(c) integer (d) natural number

(iv) In a^n, n is called
(a) radical (b) radicand
(c) exponent (d) base

(v) In 4^5, 4 is called
(a) base (b) exponent
(c) integer (d) radical

(vi) The logarithm calculated to the base "10" is called
(a) mantissa (b) common logarithm
(c) characteristic (d) natural number

(vii) In the logarithm of a number the integral part is called.
(a) characteristic (b) mantissa
(c) decimal part (d) real part

(viii) In the logarithm of a number the decimal part is called
(a) characteristic (b) mantissa
(c) rational number (d) real part

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(ix) $\sqrt{\sqrt{2}} = ?$

(a) base (b) exponent

(c) integer (d) radical

(x) $\sqrt{2+\sqrt{3}}$ is not radical, because $2+\sqrt{3}$ is:

(a) irrational (b) rational

(c) integer (d) exponent

Ans.

(i) (b)	(ii) (a)	(iii) (b)	(iv) (c)	(v) (a)	(vi) (b)
(vii) (a)	(viii) (b)	(ix) (d)	(x) (a)		

Q.2- Fill in the blanks.

(i) If $\sqrt[n]{a}$ is irrational, where "a" is rational, then $^n\sqrt{a}$ is called________.

(ii) The symbol $\sqrt[n]{\ }$ is called________.

(iii) In 3^5, 5 is called the________.

(iv) In a^n, "a" is called the________.

(v) The logarithm calculated to the base 10 is called____.

(vi) The logarithm of a number consists of two parts, the integral part is called________.

(vii) In the logarithm of a number the decimal part is called________.

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Ans.

(i) Radical	(ii) Radical sign	(iii) Exponent	(iv) Base
(v) Common logarithm	(vi) Characteristic	(vii) Mantissa	

Q.3- Simplify:

(i) $(x^5y^3)^{1/2} \times (y^7x^3)^{-1/3}$ (ii) $(a^{1/4}b^{1/3})^{-1/2} \div (a^{1/3}b^{1/4})^{-3}$

Solution:- We are given that

(i) $(x^5y^3)^{1/2} \times (y^7x^3)^{-1/3}$

$$= x^{5\times 1/2} y^{5\times 1/2} \times x^{5\times\frac{-1}{3}} x^{3/2-\frac{7}{3}}$$

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$= x^{5/2}y^{3/2} \times y^{-7/3}x^{-1} = x^{\frac{5}{2}-1}x^{3/2-\frac{7}{3}}$

$= x^{3/2}y^{-5/6}$ *Ans.*

(ii) $(a^{1/4}b^{1/3})^{-1/2} \div (a^{1/3}b^{1/4})^{-3}$

$= \dfrac{1}{(a^{1/4}b^{1/3})^{1/2}} \div \dfrac{1}{(a^{1/3}b^{1/4})^3}$

$= \dfrac{1}{(a^{1/4\times1/2}b^{1/3\times1/2})} \times a^{1/3\times3}b^{1/4\times3} = \dfrac{a\,b^{3/4}}{a^{1/8}b^{1/6}}$

$= (a^{1-1/8}b^{3/4-1/6}) = a^{7/8}b^{7/12}$ Ans.

Q.4- Evaluate:

(i) $x^{2/3}y^{5/8} \times y^{1/2} \div (xy)^{1/3}$ (ii) $\left(\dfrac{2}{5}\right)^{-1} \div \left(\dfrac{4}{25}\right) \times 625$

Solution:-

(i) $x^{2/3}y^{5/8} \times y^{1/2} \div (xy)^{1/3}$

$= \dfrac{x^{2/3}y^{5/8+1/2}}{(x\,y)^{1/3}} = \dfrac{x^{2/3}y^{9/8}}{x^{1/3}y^{1/3}}$

$x^{2/3-1/3}y^{9/8-1/3} = x^{1/3}y^{19/24}$ Ans.

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(ii) $\left(\dfrac{2}{5}\right)^{-1} \div \left(\dfrac{4}{25}\right) \times 625$

$= \dfrac{5}{2} \div 4 \times 25 = \dfrac{5}{2} \div 100$

$= \dfrac{5}{2} \times \dfrac{1}{100} = \dfrac{1}{2} \times \dfrac{1}{20} = \dfrac{1}{40}$ Ans.

Q.5- Show that $\log\dfrac{(3\times4\times5)}{7} = \log3 + \log4 + \log5 - \log7$

Solution:-

$\log\dfrac{(3\times4\times5)}{7} = \log3 + \log4 + \log5 - \log7$

$\Rightarrow \log\dfrac{(60)}{7} = \log3 + \log4 + \log5 - \log7$

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$\Rightarrow \log 8.571 = \log 3 + \log 4 + \log 5 - \log 7$

Solving the logs.

$\Rightarrow 0.9331 = 0.4771 + 0.6021 + 0.6990 - 0.8451$

$\Rightarrow 0.9331 = 1.7782 - 0.8451$

$0.9331 = 0.9331$

$L.H.S = R.H.S$

Q.6- Use logarithmic table to evaluate:

(i) $62.14 \times 0.32 \times 0.015$

(ii) $\dfrac{3.64 \times 3.94}{2.78}$

(iii) $\dfrac{(13.26)^2 \times (0.4564)}{325.5}$

Solution:-

Let

(i) $x = 62.14 \times 0.32 \times 0.015$

$\log x = \log (62.14 \times 0.32 \times 0.015)$

$\log x = \log 62.14 + \log 0.32 + \log 0.015$

$= 1.7934 + \bar{1}.5051 + \bar{2}.1761$

$= 1.7934 - 1 + 0.5051 - 2 + 0.1761$

$= 1.7934 + 0.5051 + 0.1761 - 3$

$= 2.4746 - 3 \quad = 2 + 0.4746 - 3 \quad = -1 + 0.4746$

$\log x = \bar{1}.4746$

$x = \text{Antilog } \bar{1}.4746$

$x = 0.2983$

Thus

$62.14 \times 0.32 \times 0.015 = 0.2983$ Ans.

(ii) Let

$$x = \frac{3.64 \times 3.94}{2.78}$$

$$\log x = \log \frac{3.64 \times 3.94}{2.78}$$

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$$\log x = \log 3.64 + \log 3.94 - \log 2.78$$
$$= 0.5611 + 0.5955 - 0.4440$$
$$= 1.1566 - 0.4440$$
$$\log x = 0.7126$$
$$x = \text{Antilog } 0.7126 = 5.158$$
$$x = 5.158$$

Thus given expression = 5.158 Ans.

(iii) Let

$$x = \frac{(13.26)^2 \times (0.4564)}{325.5}$$

$$\log x = \log \frac{(13.26)^2 \times (0.4564)}{325.5}$$
$$= 2 \log 13.26 + \log 0.4564 - \log 325.5$$
$$\log x = 2\,[1.1226] + [\bar{1}.6594] - 2.5124$$
$$= 2.2452 - 1 + 0.6594 - 2.5124$$
$$= -1 + 2.9046 - 2.5124$$
$$= -1 + 0.3922$$
$$\log x = \bar{1}.3922$$
$$x = \text{Antilog } \bar{1}.3922$$
$$= 0.2467$$

Thus given expression = 0.2467 Ans.

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Multiple Choice Questions

Tick ✔ the Correct Answer.

(i) $\sqrt{a}$ is a radical of order

(a) 1 (b) 2

(c) $\frac{1}{2}$ (d) 3

(ii) $x^{1/4} \div x^{+2/3}$ is equal to

(a) $x^{-5/12}$ (b) $x^{12/5}$

(c) $x^{5/12}$ (d) $x^{-1/7}$

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(iii) The product of two conjugate radicals is

(a) an irrational number (b) rational

(c) even (d) odd

(iv) $\left(x^{1/2}\, y^{1/3}\right)^6$ *is equal to*

(a) $x\,y$ (b) $x^2\, y^3$

(c) $x^3\, y^2$ (d) $(x\,y)^{3/36}$

(v) Scientific notation of 0.0000281 is

(a) 2.81×10^5 (b) 2.81×10^{-5}

(c) 28.1×10^{-6} (d) 28.1×10^6

(vi) Solution of equation $log\,(x + 1) = 2$, is

(a) $x = 7$ (b) $x = 8$

(c) $x = 99$ (d) $x = 10$

(vii) To find $log\ 32.97$, we use $log - table$ to find

(a) characteristic (b) mantissa

(c) whole number (d) fraction

(viii) Antilog 3.4568 is equal to

(a) 0.2863 (b) 2.863

(c) 286.3 (d) 0.002863

(ix) $log\dfrac{p}{qr}$ is equal to

(a) $log\,p - log\,q + log\,r$ (b) $log\,p - log\,q - log\,r$

(c) $log\,p + log\,q - log\,r$ (d) $log\,p + log\,q + log\,r$

(x) $3\ log\ 2 + log\ 5 = ?$

(a) $log\ 10$ (b) $log\ 20$

(c) $log\ p30$ (d) $log\ 40$

(xi) $log\ 3 + log\ 4 + log\ 5 - log\ 6 = ?$

(a) 1 (b) 2

(c) 3 (d) 4

(xii) The integral part of log x is called

(a) characteristic (b) mantissa

(c) real part (d) rational part

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(xiii) $\log(a^m \times b^n)$ is equal to

(a) $\log a + \log b$ (b) $m\log a + n\log b$

(c) $m(\log a + \log b)$ (d) $n(\log a + \log b)$

(xvi) $\log 200 - \log 2 = ?$

(a) 1 (b) 2

(c) 3 (d) 10

Model Class Test

Q.1- Tick ✓ the Correct Answer **(1 × 7)**

(i) Conjugate of $\sqrt{a} + \sqrt{b}$ is

(a) $\sqrt{a} - \sqrt{b}$ (b) $\frac{\sqrt{a}}{\sqrt{b}}$

(c) $\sqrt{a} + \sqrt{b}$ (d) $\sqrt{a}\sqrt{b}$

(ii) $\frac{x^3 \times x^5}{x^4}$ is equal to

(a) x^{11} (b) $x^{\frac{15}{4}}$

(c) x^4 (d) x^2

(iii) $\sqrt[3]{\sqrt{x}}$ is equal to

(a) $x^{1/3}$ (b) $x^{1/2}$

(c) $x^{1/6}$ (d) $x^{1/5}$

(iv) $\sqrt[4]{81x^{28}}$ is equal to

(a) $9x^{14}$ (b) $3x^7$

(c) $9x^7$ (d) $3x^{14}$

(v) If $\log 3 = 0.4771$ then $\log 9$ is equal to

(a) (0.4771) (b) $\frac{0.4771}{2}$

(c) $2(0.4771)$ (d) $(0.4771)^{1/2}$

(vi) $\log x + \log y - \log z$ is equal to

(a) $\log(xyz)$ (b) $\log\frac{xy}{z}$

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(c) $\log \frac{x}{yz}$ (d) $\log \frac{z}{xy}$

(vii) If $\log_a x = y$ then

(a) $a^x = y$ (b) $a^x = y$

(c) $x^a = y$ (d) $a^y = x$

Q.2- Solve any five short questions. (2×5)

(i) State three laws of exponents.

(ii) Simplify $\sqrt[3]{125x^9 y^{15}}$.

(iii) Simplify $\frac{2^3 \times 9^{-1}}{27^{1/3} \times 8^{-1/3}}$.

(iv) Write in scientific notation 0.0000286.

(v) Subtract $\bar{4}.6342$ from 2.1375.

(vi) Prove that $\log_a(mn) = \log_a m + \log_a n$.

(vii) Simplify $\log 2 + 2\log 5 - \log 3 - 2\log 7$.

Q.3- Attempt any two questions.

(i) Using logarithm table evaluate $69.13 \times 0.34 \times 0.014$.

(ii) Simplify $\frac{(x^3 y)^3 (2xy)^{-2}}{4x^{-4} y^{-5}}$.

(iii) Prove the law of logarithm $\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$.

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